[013] DETAILED DESCRIPTION OF THE INVENTION

[015] According to the present invention, this object is solved by the modified nucleic acid oligomer, the method of producing a modified nucleic acid oligomer, the modified conductive surface, the method of producing a modified conductive surface, and a method of electrochemically detecting nucleic acid oligomer hybridization events.

[055] According to the present invention, a redox-active moiety is covalently bound to a nucleic acid oligomer by the reaction of the nucleic acid oligomer with the redox-active moiety or portions thereof (see also the section "Detailed Description of the Invention"). This bond can be achieved in four different ways:

[072] Binding the nucleic acid oligomer to the conductive surface may take place before or after the redox-active moiety is attached to the nucleic acid oligomer. In the case of a redox-active protein/enzyme comprising apoprotein and cofactor(s), instead of the complete redox-active moiety, it is also possible for only the apoprotein, the apoprotein and a portion of the cofactors, or one or more of the cofactors to be attached and the redox-active moiety will be completed by subsequent reconstitution with the remaining missing portions. If a linked (at least bimolecular) electron-donor/electron-acceptor complex is used as the redox-active moiety, the electron acceptor (or donor) may, as described under b) or c) in the section "Binding a Redox-Active Moiety to a Nucleic Acid Oligomer," be attached to a terminal base, or in place of a terminal base, to the nucleic acid oligomer, and the electron donor (or acceptor) may be attached by subsequent covalent attachment to a reactive group of the electron acceptor (or donor) or, as described under a) in the section "Binding a Redox-Active Moiety to a Nucleic Acid Oligomer," by subsequent attachment to a terminal reactive group of the nucleic acid oligomer backbone at the same end (see also the section "Detailed Description of the Invention"). Alternatively, binding the nucleic acid oligomer to the conductive surface may take place before or after the spacer having a reactive group for binding the redox-active moiety is attached. Binding the already modified nucleic acid oligomer to the conductive surface, i.e. binding to the surface after the redox-active moiety is attached to the nucleic acid oligomer or after portions of the redox-active moiety are attached, or after the spacer having a reactive group for binding the redox-active moiety is attached, likewise takes place as described under a) to c) in this section.

[077] Regarding the individual steps in "Binding a Redox-Active Moiety to a Nucleic Acid Oligomer," as well as in "Binding an Oligonucleotide to the Conductive Surface," it should be noted that, in the section "Detailed Description of the Invention," the various combination possibilities of the individual steps that lead to the same end result are demonstrated in an example (Figure 2).

[080] The modification of the probe nucleic acid oligomers with a redox-active moiety may take place completely or in components of the redox-active moiety, either before or after the oligonucleotide probe is bound to the conductive surface. The various combination possibilities of the individual steps (reaction sequences) are demonstrated in the section "Detailed Description of the Invention" with the aid of Figure 2 using the example of a redox-active moiety bound to an electrode via a probe oligonucleotide.

[090] If the redox-active moiety is a photoinducibly redox-active moiety, the redox activity of the moiety is triggered only by light of a specific or any given wavelength. According to the present invention, this property is used to advantage in that electrochemical detection is triggered only by radiating light onto the surface hybrid having the general structure elec-spacer-ds-oligo-spacer-moiety (surface hybrid with hybridized target) and is maintained, at most, as long as light irradiation continues. Thus, particularly in the case of amperometric detection, if a photoinducibly redox-active moiety is used, under certain external conditions, (rather long-lasting) current will flow only if light is radiated onto the surface hybrid. Such external conditions are for example the presence of a reducing agent (or oxidizing agent) suitable for reducing (or oxidizing) a photoinductively-formed oxidized donor D^+ (or reduced acceptor A^-) of the photoinducibly redox-active moiety, and applying to the electrode a potential at which a photoinductively-formed reduced acceptor A^- (or oxidized donor D^+) of the photoinducibly redox-active moiety can be oxidized (or reduced), but the non-reduced acceptor A (or the non-oxidized donor D) cannot be oxidized (or reduced). In the section "Detailed Description of the Invention," this is explained in greater detail using various examples of an elec-spacer-ss-oligo-spacer-moiety having a photoinducibly redox-active moiety. In this way, detection using a photoinducibly redox-active moiety can be spatially limited to a certain test site or group of test sites of the oligomer chip by restricting the light to this test site or group of test sites. According to the present invention, various test sites (nucleic acid oligomer combinations) of an oligomer chip can thus be applied to a shared, continuous, electrically-conductive surface. A particular test site or

group of test sites can be addressed and amperometrically detected simply by applying a suitable external potential to the (entire) surface if precisely this test site or group of test sites is irradiated with light. The various test sites thus need not be applied to individual (micro-) electrodes that are electrically isolated from one another and individually controllable for applying a potential and reading out the current. Moreover, if surface hybrids having the general structure elec-spacer-ss-oligo-spacer-moiety are used with a photoinducibly redox-active moiety and amperometric detection, the read-out process for detecting individual sequence-specific hybridization events on the oligomer chip can be optimized by first reading out the test sites by roughly scanning them with appropriately focused light and then successively increasing the resolution capacity in the grids having hybridization events, so for example, for an octamer chip having 65,536 test sites, e.g. 64 groups of 1024 test sites each are read out, then the test site groups that are shown by amperometric measurements to exhibit hybridization events can be tested e.g. in 32 groups of 32 test sites each, and thereafter, in the test site groups that again exhibit hybridization events, the test sites are assayed individually. In this way, the individual hybridization events can be quickly assigned to specific probe oligomers with little experimental outlay.

[099] DETAILED DESCRIPTION OF THE INVENTION